Context and Issues during Post-Earthquake Rapid Evaluation of Buildings after the 2015 Nepal (Gorkha) Earthquake

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Abstract: *The authors' first-hand experiences with post-earthquake building safety evaluation and related activities after the 2015 Nepal (Gorkha) earthquake are presented. Following the earthquake, Applied Technology Council's ATC 20 Guideline or its derivatives were used for Rapid Evaluation of buildings in the earthquake-affected areas of Nepal. Various organisations and consulting companies provided their services on a volunteer and commercial basis for the evaluation efforts. These efforts provided an opportunity to evaluate the effectiveness of the processes and the issues that arose during the work. Lessons learned from these experiences regarding the effectiveness of Rapid Evaluation of damaged buildings, placarding, and training needs are discussed herein. Improvements to current building safety (usability) evaluation were proposed and an outline of further considerations for reoccupation of damaged buildings in Nepal is presented.*

1 Introduction

The M_w 7.8 2015 Gorkha earthquake occurred at 11:56 Nepal Standard Time (NST) on 25 April 2015 with a focal depth of approximately 15 km. The epicentre was near Barpak Village in Gorkha District, which is located 77 kilometres (48 miles) northwest of the capital city of Kathmandu (Figure 1). The earthquake was followed by 484 aftershocks. The most significant aftershock occurred 17 days after the first earthquake at 12:50 NST on 12 May 2015 and was M_w 7.3 with a focal depth of 18.5 km and an epicentre located northeast of Kathmandu (NSC, 2015). The aftershocks added substantially to the structural damage and number of casualties. Of the 75 administrative districts of Nepal, the earthquake sequence affected 31 districts in the Western and Central regions, with 14 of the 31 districts severely affected in terms of casualties, infrastructural losses, and damage to lifeline facilities such as hospitals, communications and water supply facilities. The earthquake sequence affected an area of approximately 30,000 square kilometres, resulting in roughly 9,000 deaths and 23,000 injuries. Overall, the earthquake damaged or destroyed approximately 850,000 houses, 6,000 buildings, and 30,000 classrooms (NRA, 2016).

The U.S. Geological Survey (USGS) made available a set of ground motions from a recording station in Kathmandu for the 25 April 2015 earthquake. The data include displacement, velocity, and acceleration time histories recorded at the station along three directions. The N-S direction was the dominant shaking direction (although a comparable level of shaking took place in the E-W direction). The recorded peak ground displacement (PGD) and peak ground acceleration (PGA) were approximately 1.4 m and 0.16 g, respectively.

Due to the extensive fatalities, injuries, damage and destruction, the 2015 earthquake sequence was by far the most devastating earthquake in Nepal since the Great Nepal earthquake in 1934 (Rana & Lall, 2013). Most of the earthquake-affected areas are not accessible by all-weather roads or any form of land transport. The most common building typologies in the earthquake-affected areas are loadbearing unreinforced masonry buildings and cast-in-situ reinforced concrete (RC) frame buildings with unreinforced masonry infill. Loadbearing buildings are

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constructed of rubble stone or fired or unfired brick with mud mortar and timber floor and roof structures. RC frame buildings are more common in urban areas and along transport corridors. More than 70% of the buildings that suffered damage or destruction were loadbearing masonry buildings (Bothara, Dhakal, Dizhur, & Ingham, 2016).

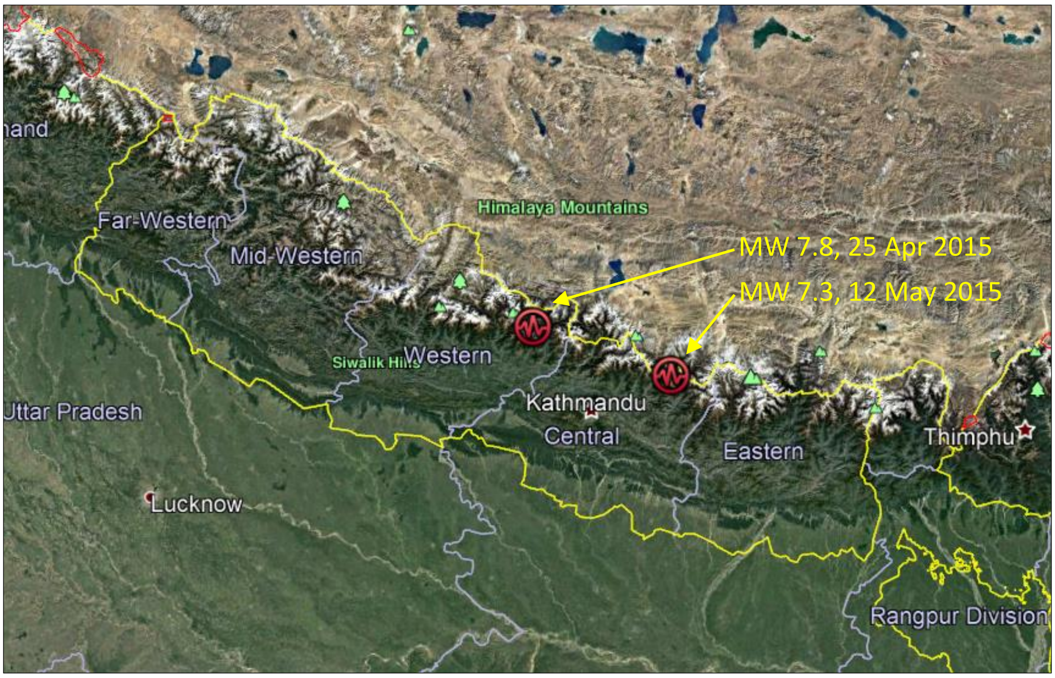

Figure 1: Location of the 2015 Nepal Earthquake Sequence (adapted from Google Map)

Following the earthquakes, in addition to addressing societal, psychological, and economic issues affecting people and communities, one of the most critical needs was triaging buildings to identify which were occupiable and which posed potential threats. For triage, it was necessary to inspect buildings quickly, efficiently, and safely. For the triage process, Rapid Evaluation of the buildings was conducted following the "Seismic Vulnerability Evaluation Guideline for Private and Public Buildings, Part II: Post Disaster Damage Assessment" (Guideline) (DUDBC, 2009), prepared by the Department of Urban Development and Building Construction (DUDBC), which is a Government of Nepal (GoN) enterprise. The Guideline is based on "Procedures for Post-Earthquake Safety Evaluation of Buildings" (ATC, 1989) and follows a traffic light system (i.e., green, yellow, or red) to define a building's safety level. However, the Guideline is limited to concrete and loadbearing masonry buildings (mainly brick buildings), while the large majority of damaged buildings in the earthquake-affected areas were constructed of rubble stone or adobe with mud mortar. In addition, the Applied Technology Council prepared a post-earthquake building safety evaluation guideline document for Bhutan in 2014 (ATC, 2014). This document provides guidance on post-earthquake building safety evaluation of Bhutanese building typologies, which are similar to Nepalese building typologies. Accordingly, this document would have been suitable for assessment in Nepal. However, engineers in Nepal were either unaware of this document or, if they were aware of it, could not afford its purchase.

Rapid Evaluation was conducted for buildings of all types of occupancy in urban areas, whereas in rural areas, these evaluations were limited to institutional buildings. The evaluation process was partly voluntary in nature, and placarding of assessed buildings was generally not practiced. The GoN conducted a separate survey in mainly rural earthquake-affected areas, with the objective of reconstruction planning. This survey classified buildings into three groups: i) collapsed, ii) semi-damaged, or iii) not damaged (or limited damage).

The earthquake sequence presented a unique opportunity to study the Rapid Evaluation process followed in Nepal and further refine the procedures for use in future earthquakes. The authors of this paper were involved in Rapid Evaluation, delivery of training on Rapid Evaluation, or other post-earthquake response activities. The authors' first-hand experiences with Rapid Evaluation and related activities undertaken after the 2015 Nepal (aka Gorkha) earthquake is presented.

2 Building Safety Evaluation Procedure

Post-earthquake safety evaluation of buildings in Nepal was largely based on the Applied Technology Council's ATC 20 procedure (ATC, 1989). The procedure is described in the guideline document published by Nepal's DUDBC (DUDBC, 2009), which suggests Windshield Evaluation to scope overall damage. In addition to Windshield Evaluation, the Guideline suggests a three-stage damage evaluation process comprising: i) Rapid Evaluation, ii) Detailed Evaluation, and iii) Detailed Quantitative Analysis (Figure 2). However, the guideline provides methodologies for Rapid Evaluation and Detailed Evaluation only. It does not provide objective and procedure for Detailed Quantitative Analysis. The methods prescribed in the Guideline for Rapid Evaluation are similar to those prescribed by ATC 20. However, the Detailed Evaluation method prescribed in the Guideline is much more extensive than that prescribed by ATC 20. The Guideline suggests that calculations and drawings be reviewed, non-destructive testing (NDT) be performed, and observed displacement be matched with a building's seismic capacity curve. Based on the description of the Detailed Evaluation provided in the Guideline, this process closely approximates the Detailed Quantitative Analysis. Per the Guideline, the purpose of the Detailed Evaluation is to assist the appraisal of compensation to households, the planning of reconstruction activity, and assessing the level of intervention required for repair and retrofitting.

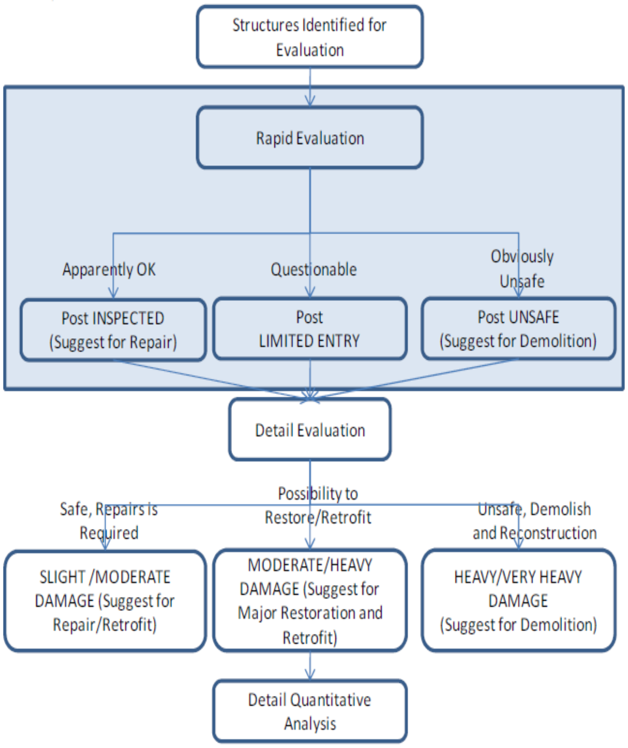

Figure 2: Post-earthquake Building Safety Evaluation Framework (DUDBC, 2009)

The Guideline proposes placarding of buildings based on a traffic light system, with evaluation results used to determine the state of buildings as Inspected (green placard), Restricted Use (yellow placard), or Unsafe (red placard), as shown in Figure 3. To facilitate the triage process, the Guideline provides an evaluation framework and forms (Figure 4) for Rapid Evaluation and Detailed Evaluation to be completed on-site for each building. The evaluation framework is provided for RC frame and load bearing masonry (brick and stone) buildings only.

As previously mentioned, the GoN conducted a separate survey to determine the inventory of collapsed, semi-damaged, and undamaged buildings for reconstruction planning purposes. In addition, some institutions developed their own methodology and forms for Rapid Evaluation and damage assessment of buildings (Pradhan, Adhikari, & Bhat, 2015).

Figure 3: Traffic Light System for Placarding Buildings (DUDBC, 2009)

The objective of Rapid Evaluation is to quickly inspect and evaluate buildings in earthquake-affected areas with the minimum manpower generally available at the time of an emergency. Rapid Evaluation typically includes only an exterior evaluation of structures and can be carried out by building inspectors, architects, or properly trained personnel, who are not required to be structural engineers. The Guideline also suggests inspection of building interiors if it is safe to do so. The Guideline recommends demolition of a building if it is deemed Unsafe (red placard) (Figure 3) although the goal of Rapid Evaluation should be to determine the appropriate placard for a building, rather than to make a decision regarding its demolition.

Rapid Evaluation Safety Assessment Form

Inspection
Inspector ID: ______ Inspection date and time: ______ ☐ AM ☐ PM
Organization: ______ Areas inspected: ☐ Exterior only ☐ Exterior and interior

Building Description
Building Name: ______ Address:
District: ______
Building contact/phone: ______ Municipality/VDC : ______
Approx. "Footprint area" (sq. ft): ______ Ward No: ______ Tole: ______

Type of Construction
☐ Adobe ☐ Stone in mud ☐ Stone in cement ☐ Brick in cement ☐ Wood frame
☐ Bamboo ☐ Brick in mud ☐ Brick in cement ☐ R.C frame ☐ Others: ______

Type of Floor
☐ Flexible ☐ Rigid
Type of Roof
☐ Flexible ☐ Rigid

Primary Occupancy:
☐ Residential ☐ Hospital ☐ Government office ☐ Police station
☐ Educational ☐ Industry ☐ Office Institute ☐ Mix
☐ Commercial ☐ Club ☐ Hotel/Restaurant ☐ Others: ______

Evaluation
Observed Conditions:

	Minor/None	Moderate	Severe
➢Collapsed, partially collapsed, or moved off its foundation	☐	☐	☐
➢Building or any story is out of plumb	☐	☐	☐
➢Damage to primary structural members, cracking of walls, or other signs of distress present	☐	☐	☐
➢Parapet, chimney, or other falling hazard	☐	☐	☐
➢Large fissures in ground, massive ground movement, or slope displacement present	☐	☐	☐
➢Other hazard (Specify) e.g tree, power line etc:	☐	☐	☐

Estimated Building Damage (excluding contents)
☐ None
☐ 0-1%
☐ 1-10%
☐ 10-30%
☐ 30-60%
☐ 60-100%
☐ 100%

Comments: ______

Posting Choose a posting based on the evaluation and team judgment. Severe conditions endangering the overall building are grounds for an Unsafe posting. Localized Severe and overall Moderate conditions may allow a Restricted Use posting. Post INSPECTED placard at main entrance. Post RESTRICTED USE and UNSAFE placards at all entrances.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: ______

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas:
☐ Detailed evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other ______

Comments: ______

Figure 4: Rapid Evaluation Safety Assessment Form (DUDBC, 2009)

The Guideline suggests that the Detailed Evaluation process be performed for all buildings, whether they are issued a green, yellow, or red placard. This process includes an in-depth investigation of a building, including detailed damage mapping and NDT. The Guideline further discusses the matching of theoretical capacity curves and earthquake-induced displacement of a building, as well as adjustment of the theoretical modelling of a building based on observed displacements. The Guideline also suggests that the evaluation should be completed by a qualified structural engineer to determine repair and retrofit options. However, the Guideline provides no recommendation regarding the continuation or replacement of placards if Detailed Evaluation changes the damage status of a building.

3 Implementation of Post-Earthquake Safety Assessment

Nepal has had a relatively short history of managing post-disaster efforts in a coherent and systematic way. The legal framework for disaster management was put in place in 1982 with the promulgation of the Natural Calamity (Relief) Act (HMG, 1982). This act allocates responsibility of preparing for and responding to disasters to the government and provides an administrative structure for disaster management within the country. However, Nepal has no legislative framework for post-earthquake building safety evaluation.

Following the 25 April 2017 earthquake, the GoN declared a state of emergency in 14 highly affected districts to facilitate earthquake response and requested assistance from the international community (MOHA, 2015). Immediately after the earthquake, the DUDBC, Nepal Engineers Association (NEA), National Society for Earthquake Technology-Nepal (NSET), and consulting companies mobilised volunteers or employees for Rapid Evaluation of buildings. The DUDBC and NSET, who are experts in the process, conducted assessments of large buildings, including hospitals and office buildings, and assigned them placards (Figure 5a and b). This exercise helped enable the immediate post-earthquake operation of these facilities. The Department of Education (DoE) also conducted Rapid Evaluation of school buildings in earthquake-affected areas and assigned placards to buildings when necessary (Figure 5c). Furthermore, many countries sent teams of engineers to support Rapid Evaluation of buildings in earthquake-affected areas. New Zealand sent a team of senior engineers who worked with DUDBC engineers to assist the GoN in performing Rapid Evaluation of institutional buildings (Figure 6a). Similarly, international non-governmental organisations and other professional bodies sent teams to support Rapid Evaluation (Figure 6b). Parallel to DUDBC's assessment process, many owners of large private buildings such as apartment buildings hired structural engineers to carry out Rapid Evaluations.

(a) Placarding by DUDBC of a hospital building in Kathmandu

(b) Placarding by DUDBC of an apartment building in Kathmandu

(a) A school building in a rural area placarded by the DoE as Unsafe

Figure 5: Post-earthquake Rapid Evaluation and Placarding

Following the 25 April 2015 earthquake, thousands of engineers arrived at NEA to provide volunteer support for the post-earthquake response. The NEA mobilised these volunteers to undertake Rapid Evaluations of residential buildings, initially in the Kathmandu Valley and later in other earthquake-affected areas. The response teams comprised two to three volunteer engineers (Figure 6c). The NEA established a call centre that enabled citizens in need of engineering services to call the organisation and request the services of an evaluation team for Rapid Evaluation of small residential and business buildings to determine their status. However, NEA did not placard houses, regardless of whether they were damaged or undamaged. Instead volunteer response teams worked as counsellors to home owners and completed Rapid Evaluation Safety Assessment Forms for inspected houses.

(a) A team comprised of Nepalese and New Zealand engineers and hospital management in Kathmandu

(b) An international team undertaking a Rapid Evaluation (EERI)

(c) NEA response team

Figure 6: Post-earthquake Rapid Evaluation teams

4 Observations and Lessons

4.1 Effectiveness of Rapid Visual Assessment

The effectiveness of Rapid Evaluation of buildings was found to vary significantly depending on the individuals carrying out an assessment. During the Rapid Evaluation process, a significant level of knee-jerk reaction was observed among assessors, and, in many cases, assessors took an extremely conservative approach without considering the consequences of their decisions or advice. Following the Guideline, engineers suggested the demolition of buildings deemed “Unsafe” (with a red placard). This decision created panic among property owners because of the potential financial consequences.

Overall, Rapid Evaluation was found to be a useful tool for enabling the continued use of lifeline buildings such as hospitals, communications, water supply facilities, and institutional buildings, and for allowing people to return to their homes. When evaluations were carried out by people well-versed in the process, the results were generally found to be satisfactory. While evaluations were largely found to be adequate for assessing the extent of damage to smaller buildings, entry to larger buildings was required to inspect damage not observable from the outside.

4.2 Training in Rapid Visual Assessment

After preparation of the Guideline document, relatively few Nepali engineers and building officials were trained in the post-earthquake evaluation of buildings. In contrast, engineers from DUDBC and NSET were generally well-versed in Rapid Evaluation of damaged buildings. Initially, NEA provided brief training sessions to volunteer engineers to complement their skills before they began conducting building evaluations (Figure 7). However, the evaluations were found to be extremely conservative and inconsistent in many instances because “safety” was considered paramount, leading to knee-jerk reactions in some cases that caused trauma to many building owners. The results of building evaluations revealed that many engineers lacked forensic skills, good engineering judgment, and the experience required for evaluation of damaged buildings. Following this experience, NEA provided more extensive trainings on Rapid Evaluation to volunteer engineers. The training sessions provided by NEA helped improve the quality of evaluations. This experience shows that in-depth training to engineers and building officials can be helpful for obtaining satisfactory results of the Rapid Evaluation process. Briefing sessions at the beginning and end of the days were organised to discuss and resolve issues arisen during the day.

(a) Classroom training (b) Field training

Figure 7: Training sessions on Rapid Evaluation following the earthquakes

As identified by Galloway et al. (Galloway, et al., 2014), it is important to convey to assessors the difficult balance that must be struck in the emergency management of buildings. While there is a need to clearly identify buildings suitable for occupation and economic continuity, it is also important for assessors to communicate the inherent risk associated with earthquakes to building owners.

4.3 Public Understanding and Communication of Risk

The earthquake sequence and resulting deaths and injuries, and damage and destruction of buildings, deeply affected the population in earthquake-affected areas and caused significant psychological and financial trauma. Buildings deemed “Unsafe” (with a red placard) were interpreted as buildings meant for demolition. Engineers relying on the Guideline played a significant role in this interpretation. In some cases, this message was spread by the media to the public.

There were significant rumours regarding the recurrence of earthquakes. This development further traumatised the already shaken population. Clairvoyants played a major role in spreading these rumours. Some blame can also be attributed to the scientific community as they provided unclear and inconsistent messaging. The media also played a significant role in informing communities about rumours. Immediately after the earthquake, many television stations broadcasted news related to the earthquake from dawn to dusk. Within the limitations of their technical understanding, the media made considerable efforts to communicate essential information to people regarding their response to the earthquake. However, the limited technical capability of media personnel resulted in the dissemination of unclear and inconsistent public safety messages in many cases.

Similar to the Canterbury earthquake sequence, the word ‘safe’ was commonly used to indicate that a building was suitable to reoccupy. However, in building safety evaluation terms, “safe” is intended to convey presence of a relative risk no greater than prior to the earthquake (Galloway, et al., 2014). Accordingly, it was extremely difficult to sell the concept that there is no such thing as an absolutely safe building to many of the Nepali engineers.

4.4 Barricading and Occupation of Damaged Buildings

A red placard in earthquake-affected areas did not imply a building could not be occupied until reassessed and red placard removed, as the legal system in Nepal does not prevent occupancy of these buildings. People often occupied or worked around buildings deemed “Unsafe” (Figure 8), regardless of whether these buildings were placarded or not. Furthermore, the barricading of severely damaged or collapsed building was not followed as a norm (Figure 9), because of logistical reasons, because it was deemed unnecessary, or because this action was not possible in many cases. As evidenced during the Canterbury earthquake sequence and subsequent earthquakes, this scenario would be totally unacceptable in New Zealand.

Undoubtedly, occupation of earthquake-damaged buildings should be based on the significance of the damage sustained and the risk posed by this damage. However, it should be appreciated that when options for alternatives are limited, people are sometimes forced to occupy damaged buildings, regardless of the risk posed. This scenario was true in Nepal, and the situation was further complicated by a lack of security of personal property. Hence, many people erected tents near their damaged houses to safeguard their property despite the risk posed by the nearby damaged building.

It should be noted that occupation of damaged buildings also depends on how risk is perceived by an individual or community. Culture, religion, race, ethnicity, faith, literacy, gender, education, and experience influence a person's or a community's interpretation and perception of risk (Okazaki, Ilki, Ahmad, Kandel, & Rahayu, 2008). With a change in scenario (i.e., experiencing an earthquake) or with increased affordability and better education, peoples' risk perception changes. However, once people begin to believe that there is little they can do to protect themselves, they slide into surrender and fatalism (Bothara & Sharpe, 2009). This scenario was observed in many cases in earthquake-affected areas of Nepal, particularly those with extensive destruction.

(a) Children playing in the debris of destroyed buildings

(b) Occupied buildings in Kathmandu with 1% tilt and severely damaged columns

(c) An occupied residential building (deemed "unsafe")

(d) School building with collapsed walls. The building was used for post-earthquake accomodation

(e) People charging cell phones in an "unsafe" school building that housed operational solar panels

(f) Occupied school building placarded as "unsafe"'

Figure 8: Occupancy of damaged buildings

(a) Barricaded damaged building

(b) Tilting building with no barricade along one of the main transport corridors in Kathmandu

(c) Severely destroyed area with unrestricted access

Figure 9: Absence of barricades around damaged buildings

5 Lessons Learned

During the post-earthquake, Rapid Evaluation of buildings several gaps in the process were found that require improvements. If improvements can be incorporated into the process, then the evaluations can become more effective and efficient. The areas for improvement are identified below:

- The 2015 Nepal earthquake essentially affected rural areas (Bothara, Dhakal, Dizhur, & Ingham, 2016). Kathmandu is the seat of government, academic institutions, and international agencies and although affected, the city mainly escaped the wrath of the disaster and the machinery necessary for earthquake response remained intact. This outcome may not be the case during future earthquakes and hence a back-up system needs to be developed.

- Self-sufficiency of the deployed Building Evaluation teams is an important issue for their efficiency and operational capability. A lack of self-sufficiency from a team can hinder response and recovery efforts.

- Although it is unacceptable to dilute building classification criteria, it is not sensible to enforce something that cannot be implemented in a given socioeconomic and cultural environment. Building classification criteria could be risk based wherein high-risk buildings (e.g., important, high-occupancy buildings and those along major transport corridors) could be evaluated against more rigorous criteria compared to low-risk buildings (e.g., small houses, buildings not along transport corridors). The concept of *incremental safety* could be useful in this context.

- The Guideline needs immediate amendment and updating due to the following reasons:
    - The purpose of the Guideline is unclear. While the Guideline states that its purpose is to provide criteria and guidance for damage assessment, there appears to be a disconnect between damage and "safety" in the evaluation of buildings;
    - The Guideline recommends demolition of "unsafe" (red placarded) buildings, which is misleading. This interpretation traumatised people who owned buildings that were standing but were marked for demolition;
    - The current classifications (i.e., Inspected, Limited Entry, and Unsafe) should be further divided into sub-classifications. A field guide developed by the Ministry of Business, Innovation and Employment (MBIE, 2014) could be useful in this context;
    - The scope and purpose of the Detailed Evaluation and Detailed Quantitative Analysis processes are unclear in the Guidelines and need to be clarified;
    - Subjecting all buildings to a full engineering evaluation as suggested by the Guideline does not make sense from a logistical and economic point of view although the intent may be good;
    - The current scope of the Guideline is limited to RC frame and loadbearing masonry (brick and stone) buildings. The guideline does not address other building typologies common in Nepal. A guideline developed for Bhutan (ATC, 2014) could be a good resource to consult for this purpose;
    - A few paragraphs in the Guideline are totally non-contextual and misleading and need to be removed;
    - The wording on the placards included in the Guideline needs amendment;
    - The Guideline mentions the term Windshield Evaluation, but provides no details on this process. A section on Windshield Evaluation could be added to the Guideline to suggest evaluation of essential facilities (i.e., hospitals, lifeline facilities, and police and fire stations) and community facilities (i.e., pharmacies, grocery stores, and hardware stores) on a priority basis.

- Whether intended or not, assessors often serve as counsellors when they inspect buildings, particularly residential buildings. Hence, the assessors must have the skills necessary to speak accurately and respectfully and understand sensitivity of the time, place, and context (e.g., a house owner may have lost relatives and hence the sanctity of the place must be maintained in a religious context). Direct criticism should be avoided in any circumstance.

- Clear communication to the public is critical to avoid confusion, rumour, and trauma during a disaster. The public and engineers need to be informed that buildings carry a level of inherent seismic risk and that they cannot be guaranteed to be earthquake-proof or safe. Suitable flyers could be prepared with clear messages and distributed during the building inspection process. The flyer could include clear messages about entering damaged buildings for retrieval of possessions, safety precautions, and general information on recovering from the disaster, including information about the building evaluation procedure and interpretation of its results.

- In-depth training on the purpose and process of Rapid Evaluation, and interpretation of observations are essential for building assessors and the people managing them. Training should include communication skills.

- In addition to training, a discussion forum during the building evaluation process and a review of a certain percentage of completed evaluations for quality control are important for consistent results. In addition to these initiatives, "flying" squads could be formed to cross-verify results on-site of a certain percentage of assessed buildings. Furthermore, a briefing and debriefing mechanism for the start and end of the day should be established. All the outcomes of discussions and cross-checks should be discussed with evaluation teams for the improvement of evaluations.

- Evaluation teams should be composed based on team members' competencies. Teams could be deployed considering the complexity of the building structures to be evaluated. For this change to happen, a database of assessors is essential. This approach would be particularly useful if the affected area is large.

- A regular check-in with the Evaluation Command Centre every few hours, by phone call or text message, would provide a good safety check. This check-in can be used as an opportunity to provide a miniature progress report, if time allows (Marshall, et al., 2012).

6 Conclusions

Lessons learned from the post-earthquake Rapid Evaluation of buildings following the 2015 earthquake sequence in Nepal are outlined. These lessons relate to the context and effectiveness of Rapid Evaluations, the triage process of buildings, and training needs. Improvements were proposed pertaining to the current building safety assessment processes and an outline was presented of further considerations for reoccupation of damaged buildings in the context of Nepal.

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